

What is claimed is:

1. A method of measuring a concentration of a material comprising:  
  
irradiating an infrared light onto a semiconductor substrate having a layer formed thereon, the layer including a first material and a plurality of dopants of which an entire intensity is less than an intensity of the first material, wherein a portion of the infrared light is absorbed in the semiconductor substrate including the layer and a remaining portion of the infrared light is transmitted through the semiconductor substrate including the layer;  
  
computing intensities of the infrared light absorbed in the first material and the plurality of dopants in accordance with light wave numbers by utilizing a difference between an entire intensity of the infrared light and an intensity of the infrared light transmitted through the semiconductor substrate including the layer and by utilizing a difference between an entire intensity of the infrared light absorbed in the semiconductor substrate including the layer and an intensity of the infrared light absorbed in only the semiconductor substrate;

observing light wave number regions respectively corresponding to predetermined intensities of the infrared light absorbed in the first material and the plurality of dopants among all the light wave number regions absorbed in the first material and the plurality of dopants; and

obtaining concentrations of each of the plurality of dopants by utilizing a ratio of the light wave number regions corresponding to the predetermined intensities of the infrared light absorbed in each of the dopants with respect to the light wave number region corresponding to the predetermined intensity of the infrared light absorbed in the first material.

2. The method of measuring a concentration of a material as claimed in claim 1, wherein the first material includes silicon and the plurality of dopants include boron and phosphorus.

3. The method of measuring a concentration of a material as claimed in claim 1, further comprising:

measuring an intensity of the infrared light absorbed in the semiconductor substrate, prior to forming the layer including the first material and the plurality of dopants on the semiconductor substrate.

4. The method of measuring a concentration of a material as claimed in claim 1, wherein a plurality of conductive patterns are formed on the semiconductor substrate.

5. A method of measuring a concentration of a material comprising:

irradiating an infrared light onto a semiconductor substrate having a layer formed thereon, the layer including a first material and a plurality of dopants of which an entire intensity is less than an intensity of the first material, wherein a portion of the infrared light is absorbed in the semiconductor substrate including the layer and a remaining portion of the

infrared light is transmitted through the semiconductor substrate including the layer;

computing intensities of the infrared light absorbed in the first material and the plurality of dopants in accordance with light wave numbers by utilizing a difference between an entire intensity of the infrared light and an intensity of the infrared light transmitted through the semiconductor substrate including the layer and by utilizing a difference between an entire intensity of the infrared light absorbed in the semiconductor substrate including the layer and an intensity of the infrared light absorbed in only the semiconductor substrate;

observing light wave number regions respectively corresponding to predetermined intensities of the infrared light absorbed in the first material and the plurality of dopants among all the light wave number regions absorbed in the first material and the plurality of dopants; and

obtaining concentrations of each of the plurality of dopants by utilizing a ratio of the intensity of the infrared light absorbed in each of the plurality of dopant corresponding to an entire light wave number regions with respect to

the light wave number region corresponding to the predetermined intensity of the infrared light absorbed in the first material.

6. The method of measuring a concentration of a material as claimed in claim 5, wherein the first material includes silicon and the plurality of dopants include boron and phosphorus.

7. The method of measuring a concentration of a material as claimed in claim 5, further comprising:

measuring an intensity of the infrared light absorbed in the semiconductor substrate, prior to forming the layer including the first material and the plurality of dopants on the semiconductor substrate.

8. The method of measuring a concentration of a material as claimed in claim 5, wherein a plurality of conductive patterns are formed on the semiconductor substrate.

9. A method of measuring concentrations of dopants in a semiconductor device comprising:
  - forming a plurality of conductive patterns on a semiconductor substrate;
  - forming a first BPSG layer on the semiconductor substrate including the conductive patterns;
  - irradiating a first infrared light onto the semiconductor substrate including the conductive patterns and the first BPSG layer, wherein a portion of the first infrared light is absorbed in the semiconductor substrate including the conductive patterns and the first BPSG layer and a remaining portion of the first infrared light is transmitted through the semiconductor substrate including the conductive patterns and the first BPSG layer;
  - computing intensities of the first infrared light respectively absorbed in dopants included in the first BPSG layer in accordance with first light wave numbers by utilizing a difference between an entire intensity of the first infrared light and an intensity of the first infrared light transmitted through the semiconductor substrate including the conductive patterns and the first BPSG layer, and by utilizing a difference between an entire intensity of the

first infrared light absorbed in the semiconductor substrate including the conductive patterns and the first BPSG layer and an intensity of the first infrared light absorbed in only the semiconductor substrate including the conductive patterns; and

obtaining concentrations of a first boron dopant and a first phosphorus dopant by utilizing a ratio of the first light wave number regions corresponding to predetermined intensities of the first infrared light absorbed in the first boron dopant and the first phosphorus dopant of the first BPSG layer with respect to the first light wave number region corresponding to a predetermined intensity of the first infrared light absorbed in a first silicon of the first BPSG layer.

10. The method of measuring a concentration of a dopant as claimed in claim 9, further comprising:

forming a second BPSG layer on the first BPSG layer of which concentrations of the first boron and the first phosphorus are obtained;

irradiating a second infrared light onto the semiconductor substrate including the second BPSG layer, wherein a portion of the second infrared

light is absorbed in the semiconductor substrate including the second BPSG layer and a remaining portion of the second infrared light is transmitted through the semiconductor substrate including the second BPSG layer;

computing intensities of the second infrared light respectively absorbed in a second silicon, a second boron dopant and a second phosphorous dopant included in the second BPSG layer in accordance with second light wave numbers by utilizing a difference between an entire intensity of the second infrared light and an intensity of the second infrared light transmitted through the semiconductor substrate including the second BPSG layer, and by utilizing a difference between an entire intensity of the second infrared light absorbed in the semiconductor substrate including the second BPSG layer and an intensity of the second infrared light absorbed in only the semiconductor substrate including the conductive patterns and the first BPSG layer; and

obtaining concentrations of the second boron dopant and the second phosphorus dopant by utilizing a ratio of the second light wave number regions corresponding to predetermined intensities of the second infrared light absorbed in the second boron dopant and the second phosphorus



dopant included in the second BPSG layer with respect to the second light wave number region corresponding to a predetermined intensity of the second infrared light absorbed in the second silicon of the second BPSG layer.

11. The method of measuring a concentration of a dopant as claimed in claim 10, wherein the measuring of the concentration of a dopant is repeatedly performed more than twice.

12. A method of measuring concentrations of dopants in a semiconductor device comprising:

selecting a sample of a semiconductor substrate on which a BPSG layer is formed during a semiconductor device manufacturing process;

obtaining an intensity of an infrared light absorbed in the BPSG layer formed on the sample with respect to a wave number of the infrared light;  
and

obtaining concentrations of boron and phosphorus included in the BPSG layer formed on the sample by utilizing a ratio of light wave number

regions corresponding to a predetermined intensities of the infrared light absorbed in the boron and the phosphorus with respect to a light wave number region corresponding to a predetermined intensity of the infrared light absorbed in a silicon included in the BPSG layer.

13. The method of measuring concentrations of dopants as claimed in claim 12, wherein the semiconductor device manufacturing process proceeds with the sample when the concentrations of the boron and the phosphorus included in the BPSG layer as acceptable as required for the semiconductor device manufacturing process.

14. The method of measuring concentrations of dopants as claimed in claim 12, further comprising:

removing the BPSG layer and forming a new BPSG layer including boron and phosphorus having newly adjusted concentrations on the semiconductor substrate when the concentrations of the boron and the phosphorus included in the previous BPSG layer is not acceptable as required for semiconductor device manufacturing process.